

Atty Docket No. JCLA12157

Serial No. 10/605,478

REMARKS**Present Status of Application**

Claims 1-20 remain pending in the application. The Office Action mailed November 24, 2004, objected the specification and claims 12 and 18 for informalities. Claims 1-7, 12 and 18-20 were rejected under U.S.C. 103(a) as being unpatentable over Bayman et al. (US Patent No. 6,596,654) in view of Gondhalekar et al. (US Publication No. 2004/0126952 A1). Claims 8-11 and 13-17 were rejected under U.S.C. 103(a) as being unpatentable over Bayman et al..

Claims 1, 16 and 20 have been amended, while claims 4, 8-15 and 17-19 have been cancelled. The specification has been amended. Applicant believes that these changes do not introduce new matter and reconsideration of those claims is respectfully requested. In view of the above amendments and the following discussions, a notice of allowance is respectfully solicited.

Discussion for objections

The specification and claims 12 and 18 were objected for informalities. The Examiner pointed out that the term " μ m" was incorrectly listed as " \square m".

Applicants respectfully state that the terms " μ m" were correctly presented in the originally filed specification and claims 12 and 18. However, as the present application was filed through the electronic filing system (EFS), it is believed that the symbol " μ " be incorrectly translated by the EFS software. Accordingly, amendments have been made to the specification to correct the mistranslated terms " \square m" into terms " μ m".

Withdrawal of these objections is respectfully requested.

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Discussion for 35 U.S.C. 103 rejections

Claims 1-7, 12 and 18-20 were rejected under U.S.C. 103(a) as being unpatentable over Bayman et al. (US Patent No. 6,596,654) in view of Gondhalekar et al. (US Publication No. 2004/0126952 A1). Claims 8-11 and 13-17 were rejected under U.S.C. 103(a) as being unpatentable over Bayman et al..

Claims 1 and 16 have been amended to clearly define the scopes of the present invention respectively. Claims 4, 8-15 and 17-19 have been cancelled. Claim 20 has been amended for correct dependency.

As amended, independent claims 1 and 16 recite respectively:

*Claim 1. A silicon oxide gap-filling process, comprising:
providing a substrate having a trench thereon, wherein an aspect ratio of the trench is 4.0 at least; and*

performing a CVD process having an etching effect to fill up the trench with silicon oxide, wherein reaction gases used in the CVD process comprise deposition gases and He/H₂ mixed gas as a sputtering-etching gas, wherein an ED ratio of the CVD process is 0.03-0.1 and a percentage of the He/H₂ mixed gas in the total reaction gases is 70% at least.

*Claim 16. A silicon oxide gap-filling process, comprising:
providing a substrate having a trench thereon, wherein an aspect ratio of the trench is at least 4.0;*

performing an HDP-CVD process to fill up the trench with silicon oxide, wherein reaction gases used in the HDP-CVD process comprise SiH₄, O₂, He and H₂, wherein a flow rate of SiH₄ is 20-100sccm, a flow rate of O₂ is 40-200sccm, a flow rate of H₂ is 100-2000sccm, a flow rate of He is 200-2000sccm, a pressure is 5-20mTorr, a temperature is 400-650 °C, a low-frequency RF power is 3000-15000W, and a high-frequency RF power is 500-5000W;

*an ED ratio of the HDP-CVD process is 0.1-0.03; and
a percentage of the He/H₂ mixed gas in the total reaction gases is at least 70%.*

Applicant respectfully asserts that the process(es) of the present application is patentably distinct from the prior art reference. Especially, the process comprises performing a CVD process with a percentage of the He/H₂ mixed gas in the total reaction gases being at least 70% and an ED ratio of the CVD process being 0.03-0.1, for filling the trench having an aspect ratio of at least 4.0.

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The Office Action considered that Bayman substantially disclosed this invention, and relied on Gondhalekar for teaching the lacking features.

Bayman merely discloses CVD processes for filling gaps.

However, as recognized by the Office Action, Bayman teaches an ED ratio of 0.14. According to Bayman's Fig. 1A, data was taken under two sets of process conditions: S/D ratio = 0.14 and 0.17, respectively. Moreover, Bayman pointed out that voids essentially disappear during the process with S/D ratios at the range of 0.18/0.14 (Fig. 1B). Obviously, not only Bayman fails to teach or suggest an ED ratio of the CVD process being 0.03-0.1, Bayman but also fails to recognize the significance of such ED ratio range.

Contrarily, as stated in the present invention, the ED ratio of the CVD process should be adjusted down to about 0.03-0.1, so as to prevent problems like corner clipping. Moreover, with such ED ratios, the gap-filling process of this invention can be completed in a single step without changing process parameters and the resultant structures are formed without voids.

In addition, even considering Bayman unintentionally disclosing certain experimental data fallen within the ranges of specific parameters, Bayman mentions nothing explicitly about performing a CVD process with a percentage of the He/H₂ mixed gas in the total reaction gases being at least 70% and an ED ratio of the CVD process being 0.03-0.1, for filling the trench having an aspect ratio of at least 4.0.

Therefore, Bayman fails to teach the CVD process, as recited in independent claims 1 and 16. Even in combination of Gondhalekar's teachings of filling a trench with an aspect ratio of 4.0 or greater, Gondhalekar can not completely remedy the deficiencies of the reference Bayman.

Because both cited references fail to teach, suggest or disclose each and every feature of the

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present invention, and therefore they cannot possibly arrive at the claimed invention, as suggested by the Office Action. Accordingly, Applicants respectfully submits that independent claim 1 or 16 patentably defines over the prior art references, and should be allowed. Dependent claims patentably distinguish over the cited references, either alone or in combination, for at least the reasons stated above as well as for the additional features that these claims recite.

Therefore, reconsideration and withdrawal of these 103 rejections are respectfully requested.

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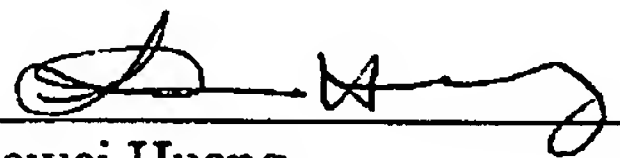
CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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